# Rad-Hard, Wide Bandgap, Single Inductor Multiple Output (SIMO) Converters, Phase I

Completed Technology Project (2018 - 2019)

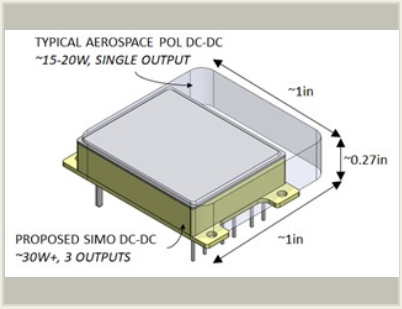
## Project Introduction

All space missions utilize low-voltage power for small signal, processor core and peripheral systems. The traditional approach for non-isolated point of load (POL) converter systems is to perform multi-stage down-conversions from space bus down to 5V, then down to the lower core voltages for provision of power to processors and small-signal components. We are proposing to research and develop a new high-performance, single-stage, multiple-output aerospace grade POL converter that reduces total size/weight costs of supplying POL voltages by up to 50%. The proposed approach is centered on a single inductor multiple output (SIMO) converter design that aims to demonstrate significant improvements to the size, weight and power (SWaP) metrics thought implementation of a high-density, high-speed switching GaN-based power architecture combined with a custom RadHard by design ASIC controller. The importance here is that a SIMO converter can furnish many independently regulated POL outputs using a single power stage, eliminating all but a one inductor across multiple POL supplies. The proposed SIMO converter approach presents a multi-output converter topology that, while eliminating the need for multiple magnetic components, can provide numerous fully-independent, well-regulated outputs with industry leading electrical performance.

## Anticipated Benefits

By removing a key size/weight obstacle with a high specific power/very high efficiency, HighRel solution, the proposed research may be pivotal for enabling transition of a wide range of NASA science missions including higher Earth orbit missions and deep-space missions such as Europa and Jupiter missions to CubeSats SmallSat/CubeSat platforms.

The high radiation tolerant WBG switching converter developed will be directly relevant to many non-NASA applications such as mobile devices, commercial drones, internet of things devices, microcontroller systems, wireless devices, high density power systems, small signal regulators for larger systems. The initial application will be military and commercial SmallSats where these launched systems face the same issues in reducing platform size without loss of performance.

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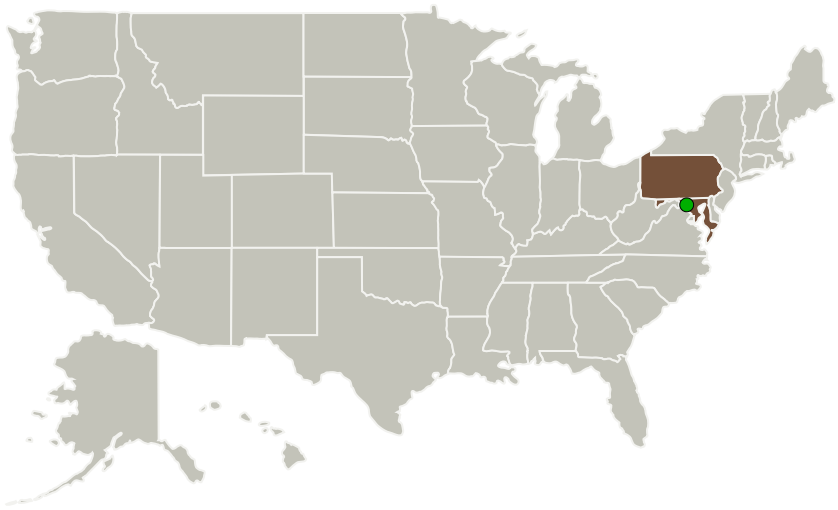
## Primary U.S. Work Locations and Key Partners



| Organizations Performing Work | Role | Type | Location |
|---|---|---|---|
| QorTek Inc | Lead Organization | Industry<br>Small Disadvantaged Business (SDB) | Williamsport, Pennsylvania |
| Goddard Space Flight Center(GSFC) | Supporting Organization | NASA Center | Greenbelt, Maryland |

| Primary U.S. Work Locations | |
|---|---|
| Maryland | Pennsylvania |

## Project Transitions

**July 2018:** Project Start

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Organization:**

QorTek Inc

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

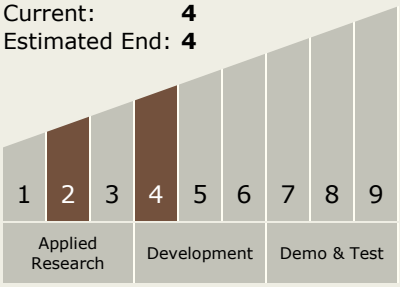
Carlos Torrez

**Principal Investigator:**

Gareth J Knowles

## Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



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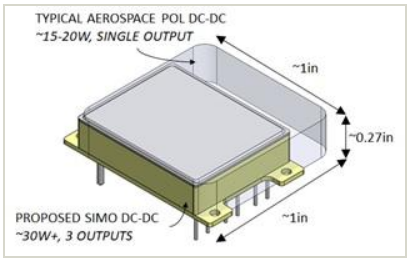
**February 2019:** Closed out

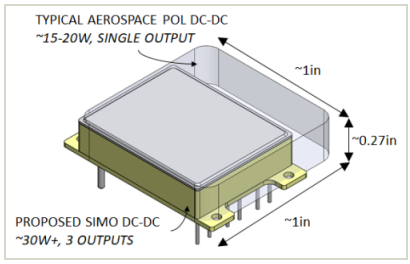
**Closeout Documentation:**

- Final Summary Chart*(https://techport.nasa.gov/file/137891)*

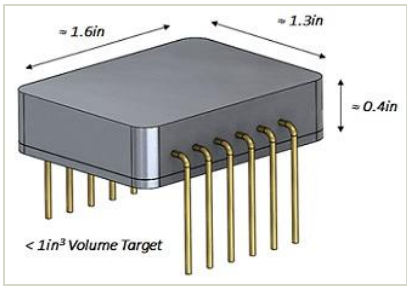
## Images




**Briefing Chart Image**
Rad-Hard, Wide Bandgap, Single Inductor Multiple Output (SIMO) Converters, Phase I
*(https://techport.nasa.gov/image/136080)*




**Final Summary Chart Image**
Rad-Hard, Wide Bandgap, Single Inductor Multiple Output (SIMO) Converters, Phase I
*(https://techport.nasa.gov/image/131787)*




**Final Summary Chart Image**
Rad-Hard, Wide Bandgap, Single Inductor Multiple Output (SIMO) Converters, Phase I
*(https://techport.nasa.gov/image/129385)*

## Technology Areas

**Primary:**

- TX03 Aerospace Power and Energy Storage
  - TX03.3 Power Management and Distribution
    - TX03.3.3 Electrical Power Conversion and Regulation

## Target Destinations

Earth, The Moon, Mars